

## **Toxicogenomic Effects of Peracetic Acid and Sodium Hypochlorite on *Pseudomonas* (How Do Antimicrobials Work Against Bacteria?)**

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*Pseudomonas aeruginosa* (*P. ae*) is a ubiquitous gram-negative bacterium that grows in water, soil, plants, and animals. As an opportunistic pathogen, *P. ae* is able to infect people, especially those with defective immune system function, such as cystic fibrosis, when they come in contact with contaminated surfaces. Disinfectants or antimicrobials have been used in hospitals and other healthcare facilities for surface sterilization. However, the extent of the resistance of *P. ae* to disinfectants is still unknown. Although mechanisms have been proposed describing the lethality of disinfectants and development of resistance in bacteria, there is still a lack of understanding of the effects of disinfectants on global gene expression profiles, which determine the biological functions in cells. OPP's new Microarray Research Laboratory is learning how these antimicrobial agents affect bacteria.

Recent advances in the field of genomics, such as whole-genome DNA microarrays, may solve this problem by enabling simultaneous multiple gene analysis. Responsive genes that interact and regulate with each other via a complicated network can be universally profiled following exposure to antimicrobials. The goals of this research are to analyze genome-wide changes in *P. ae* in response to exposure to antimicrobials using DNA microarray technology (Affymetrix GeneChip system) and to compare the responding genes with those of other bacteria and determine signature genes correlated to a mechanism of action and resistance development. In this study, peracetic acid and sodium hypochlorite were selected as target disinfectants because they supposedly elicit DNA damage and repair. *P. ae* was incubated with peracetic acid or sodium hypochlorite at a concentration that led to strong growth inhibition, but not cellular death. Total RNA was then extracted and reverse-transcribed to cDNA, and labeled cDNA was hybridized onto the Affymetrix *P. ae* GeneChip array. Finally, this information is being analyzed to more accurately determine the mechanisms by which disinfectants kill bacteria.

Illustrations: Hospital scene; colorful graphic representations of the effects of peracetic acid and sodium hypochlorite on *Pseudomonas aeruginosa*; a cell viability test with peracetic acid; RNA; DNA; and scatter plots of signal intensities from *Pseudomonas aeruginosa* microarray experiments.